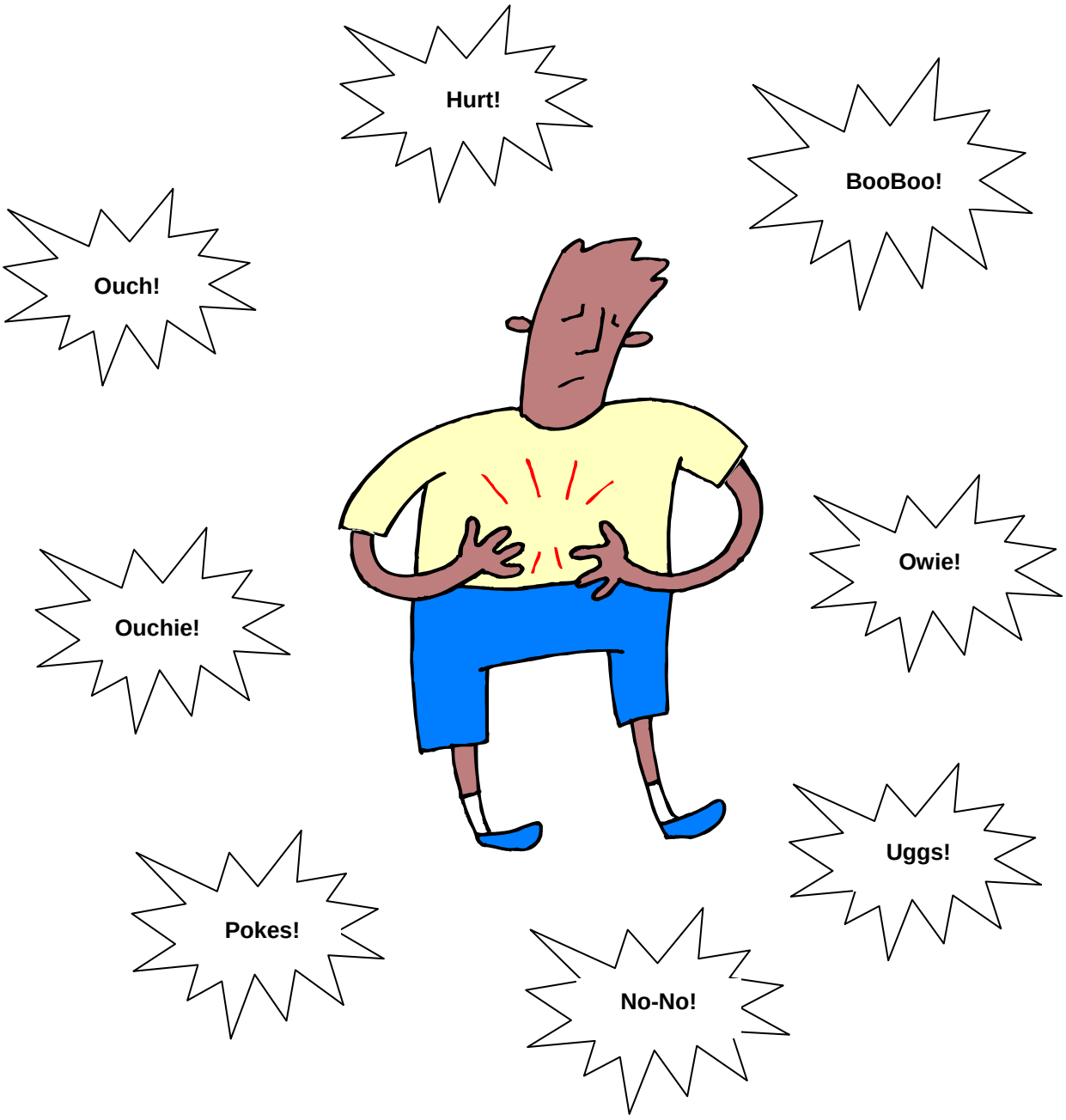
TCHP Education Consortium

Pediatric Pain Management



Pediatric Pain Management

Introduction/Purpose Statement

It is common knowledge that pain is not particularly well managed in health care today. (Carling, 1997) Many bemoan the fact that we don't always apply what we already know how to do. This problem is compounded many times over in the pediatric population. Acute pain is one of the most familiar undesirable sensations experienced by children because of the consequences of illness, injury, or medical procedures. Children often receive little or no attention paid to their pain, even when it is severe. Because children often cannot speak for themselves, nurses must become strong patient advocates in the area of pain management. The purpose of this home study is to help you to become a better advocate for your tiny charges.

Some Terminology:

- An infant is a baby who is less than 12 months of age.
- A neonate is a newborn infant less than one month of age.
- A preterm or premature neonate is an infant born before completion of 37 weeks gestation.

Target Audience

This home study was designed for nurses who have little to no familiarity with pediatric pain management; however, other health care professionals are invited to complete this packet.

Content Objectives

1. Identify the physiological basis of pain.
2. Correlate possible manifestations of pain to developmental age.
3. Describe three essential components of pain assessment.
4. Describe one or more medications that are used for pain management in children.
5. Identify at least three non-pharmacological interventions for pain.
6. Identify three or more common misconceptions about managing pain in children.

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Please see the last page of the packet before the post-test for information on submitting your post-test and evaluation for contact hours.

What is Pain?

We all know what pain is when we feel it, but it can be hard to describe it to another person, particularly if there is not an obvious reason to be feeling pain. Let's look at the mechanisms involved internally in eliciting a pain response.

Mike is a 10 year-old who just smashed his thumb while trying to pound in a nail.

The mechanical nociceptors in Mike's thumb sensed the smashing blow of the hammer. Mike's thumb, as well as his joints, skin, muscle, blood vessels, and viscera are loaded with nociceptors. Nociception can travel on fast A-delta fibers or the slower C-fibers. Mike's A-delta fibers are definitely stimulated and transmit impulses along rapidly. The A-delta fibers go to work on two different levels. First, they initiate the withdrawal reflex. Second, A-delta fibers carry nociceptive (pain) impulses to the thalamus at high speed. The A-delta fibers are myelinated to preserve and speed impulse transmission and produce the "first" or "rapid" pain that occurs early after an injury. Mike responds to this "first" pain by dropping the hammer, grabbing his thumb, and jumping around while screaming loudly. This "first" pain is sharp and localized.

> Nociceptors are sensory neurons that transmit pain impulses and respond to damage caused by mechanical, thermal, and chemical insults.

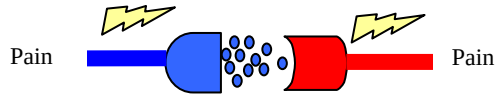
C-fibers are also present in Mike's thumb. The C-fibers are unmyelinated and transmit impulses slowly, resulting in the "second" or "slow" pain. Mike notices this "second" pain as he goes to find his mother. His thumb slowly starts to have a prolonged, dull, aching, throbbing pain that is poorly localized. His whole thumb is throbbing and sore.

Chemical mediators such as prostaglandins, histamine, serotonin, bradykinins, and leukotrienes were released by the tissues in Mike's thumb when it was damaged. These mediators activate or sensitize nociceptors, helping to move the pain impulse from Mike's thumb to his spinal cord. These mediators also cause inflammation, spreading from the area hit by the hammer into uninjured tissues.

Transmission of Painful Stimuli

When Mike smashed his thumb, the dendrites of nerve cells picked up the stimulus and transmitted it along the cell's axon to the synaptic junction. At the synaptic junction, chemicals (neurotransmitters, such as Substance P) were released that traveled across the synaptic cleft to the next nerve cell. This is how a stimulus was transmitted from nerve cell to nerve cell by neurotransmitters until it reached the spinal cord.

Figure 1: Cell to Cell transmission of Nociceptive Impulses



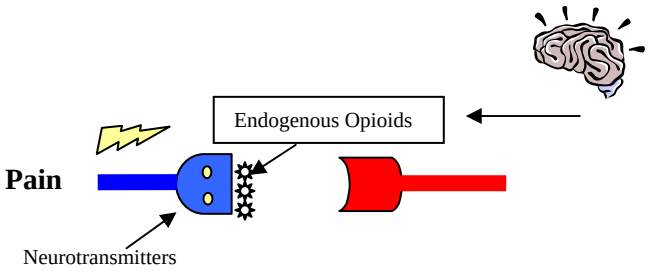
A nerve cell transmits a pain impulse to the end of its axon and converts the message to a chemical form	Neurotransmitters are released at the synaptic junction and travel across to "dock" on receptor sites of adjacent nerve cells	Dendrites of adjacent nerve cells pick up the chemical message and pass it along in electrical form through their dendrites, cell bodies, and axons

A pain stimulus will not change into a transmitted impulse unless the stimulus is strong enough to create an action potential. The thalamus, in the brain, sets the threshold for an action potential. This threshold withholds transmission of a pain impulse until the stimulus is at a significant level of importance.

Processing of Pain

It is in the spinal cord that the first "processing" of painful stimuli occurs. Pain can be transmitted through the spinal cord to the brain or be inhibited. Nociceptors that are carrying information from the periphery terminate in the dorsal horn of the spinal cord. Because the nociceptors end there, neurotransmitters are needed to carry the pain impulse across from the nociceptors to the neurons of the dorsal horn. It is at this site that opioids (both exogenous and endogenous) can modulate pain perception. Opioids lock onto the opioid receptors and block the release of neurotransmitters. There are neurons that originate in the brain stem that descend to the dorsal horn of the spinal cord. These descending fibers release endogenous opioids, as well as other substances that bind to opioid receptor sites and prevent the transmission of pain impulses. Endogenous pain modulation is a survival mechanism and helps to explain why there is a wide variation of pain perception from one person to the next. Don't rely on endogenous opioids for analgesia, though, because they degrade quickly.

Figure 2: Endogenous Pain Modulation



Nociceptors carry the pain impulse to the dorsal horn of the spinal cord.

Descending fibers from the brain stem release endogenous opioids that block the release of neurotransmitters. This prevents the pain impulse from continuing up the spinal cord to the brain.

Now, back to Mike…

Even though there is a lot of synapsing and transmitting of impulses going on with that hammer blow, the basic sensation of pain occurs at the level of Mike's thalamus. Through interconnections between the thalamus and the somatosensory cortex, precision and discrimination are added. This makes Mike aware that the hammer hurt the end of his left thumb, that it was a crushing pain, and that it hurt a lot.

If Mike dropped the hammer on his foot, he would not have to see the hammer injure his foot because his association cortex would be able to interpret the hammer falling out of his hand as being the cause of the sudden pain in his foot. The parietal cortex associates the pain to other remembered sensations to add to the perception of pain. There are also connections between the thalamus and the limbic cortex that are probably associated with the hurtfulness as well as the mood altering and attention narrowing effects of pain. (Gosen and Poor, 1997)

The gate control theory describes how painful stimuli can be altered at the spinal level (i.e., pain is altered before it is felt). This theory is important in nonpharmacologic pain control. Melzack and Wall postulated that painful stimuli pass through a "gate" on the way to the central nervous system. The "gate" is controlled by inhibitory neurons within the spinal cord that can either block or intensify pain impulses when stimulated. To inhibit pain sensation, the gate can be closed by three main methods:

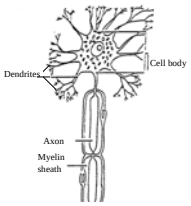
1. Non-painful sensory input can close the gate. This explains why cutaneous stimulation such as heat or cold, TENS, or massage can help control pain. We often do this unconsciously by rubbing a sore area to make it feel better.

2. The brain stem can project inhibitory impulses that close the gate to transmission of painful impulses. This mechanism works so that if the person is receiving excessive sensory input, the gate is closed to some incoming stimuli. Distraction strategies such as guided imagery can be an excellent source of sensory input that may allow the person to "tune out" pain.

3. The cerebral cortex and the thalamus are areas where thoughts, emotions, and past experiences are stored. It is thought that inhibitory signals from these areas can reduce pain and assist in closing the gate. Pain can be reduced by decreasing anxiety and increasing feelings of control over the situation.

Figure 3: The Path of Pain Impulses

Noxious stimulation is detected by the nociceptors



If the noxious stimulation is above the threshold set by the thalamus, depolarization occurs and the pain impulse is transmitted cell to cell until it reaches the spinal cord.

Once the pain impulse reaches the spinal cord, it can either travel up to the brain or be inhibited (Gate Control Theory).

The thalamus and the somatosensory cortex localize the pain and help interpret the meaning of the sensation.

What Else is Pain?

In the past, we assumed that the nociceptive system functioned as a passive relay mechanism. There was a stimulus (tissue damage) and it was relayed to the brain producing a response (ouch!).

Research has changed how we view the nociceptive system. Instead of being a passive relay, the nociceptive system is complex and integrative with the ability to respond differently to equal amounts of tissue damage (also known as plasticity). A diverse array of situational, behavioral, and emotional factors are involved in the plasticity of pain perception. These factors are continually changing and are context-specific. Individual characteristics (sex, age, cognitive level, previous pains, family learning, and culture) shape how the sensations evoked by tissue damage are interpreted. These factors are relatively stable in a given situation but evolve over time.

What Does This Mean?

What is excruciating for one person may be merely uncomfortable for another. What was uncomfortable at one time in your life might be excruciating at another time. Pain is really a subjective phenomenon where cognition, memory, and emotion all contribute to an individual's pain experience. This is especially important in the pediatric patient, since it may set the tone for the rest of the life span. It is vital that children receive appropriate attention to their pain and anxiety.

To address pain and anxiety in children, it is important to first understand the multifactorial nature of pain. There are individual differences in temperament, past history and experience, and cognitive and developmental level. There are also environmental and situational factors such as culture and family, the child's own expectations, etc. that also contribute to the child's anxiety and perception of pain. Margo McCaffery, a renowned nursing expert in the area of pain management, says that whatever would hurt an adult will also hurt a child **and** there may be some things that hurt a child that do not hurt an adult (IVs, shots, blood draws, etc.). (McCaffery and Pasero, 1999, p. 640)

Pain in the Pediatric Patient

Common Misconceptions

There are a number of misconceptions that abound concerning the management of pain in children. Here are a selected few:

Children do not remember pain.

Research indicates that children as young as six months do have memory of painful experiences. In addition, the limbic system and diencephalon, which are responsible for memory, are well developed in the neonate.

Opioids are "unsafe" for children.

Research indicates that children over eight months of age have no more respiratory depression than adults do.

Pain is absent or is not as intense in infants because they have an immature nervous system.

The following data strongly suggest that infants have the capacity to feel pain at birth, even if they are premature:

- ✓ *Children have the same number and density of nociceptive nerve endings as adults.*
- ✓ *Although neonates have a greater number of unmyelinated fibers, the distances an impulse has to travel is less and pain impulses do transmit in these fibers.*
- ✓ *Substantial cortical development is complete by 20 weeks gestation.*
- ✓ *Neurochemical systems are present.*
- ✓ *Physiologic and behavioral responses do occur.*

That pain is not harmful

Unrelieved pain carries profound physiological and psychological consequences. (Dahl, 2001) At the very least, activity, appetite, and sleep will be affected. (AHRQ, March 1994) At the very worst pain can affect nearly every body system, negatively impacting hemodynamic, respiratory, metabolic, and neurological stability. (Turner, 2005)

Caitlyn is a 5 year-old with a broken arm. She fell out of a tree she was climbing, fracturing her right ulna and radius. Her mother states that Caitlyn cried loudly all the way in the car but now is sleeping in her mother's arms.

If there is one thing I think we can all agree on, it's that Caitlyn is not miraculously pain-free just because she fell asleep. Children often will fall asleep even when they are in severe pain because they are exhausted or may be using sleep to cope with pain. This does not mean that their pain is under control! This is why it is vital to do round-the-clock dosing at first when there is a clear reason to expect pain (trauma, post-operative, sickle cell crisis, etc.). When dosing is made prn, well-meaning adults will often skip medications if they come upon a sleeping child. This causes children to awaken in severe pain, making it much more difficult to get the pain under control than if round-the-clock-dosing was maintained. Immediate attention should be paid to Caitlyn's pain. Medication should be given and time allowed for it to work before Caitlyn is jostled around for x-rays, casting, or other tests. In addition, staff may need to address Caitlyn's anxiety.

Cognitive Stage and a Child's Perception of Pain

One way of describing the relationship between a child's cognitive development and pain is to summarize ways of thinking about pain that the present evidence suggests are typical of various cognitive stages and to consider the implications of those perspectives.

Preoperational Stage (2-6 years)
Children appear to understand pain as a physical entity that is unpleasant. They may attribute pain to breaking the rules. Staff should be careful to avoid reinforcing this notion by suggesting that recovery depends on good behavior.

Children tend to perceive most pains as occurring on the outside of the body and may not attend as closely to signals of internal pathology. The concept of an internal pain may be limited to the "tummy" and a tummy-ache can mean "I have a pain somewhere inside me." Younger children seem to be more familiar with the words *hurt* and *sore*, rather than *pain.* It might be better to ask the child to "show me where it hurts" rather than "tell me about your pain." Children less than 6 years of age tend to describe their pain using simple sensory aspects—sore, hurt, big, small, bad, etc.

Young children are strongly influenced by what they see and care should be taken to keep unpleasant pathology and medical instruments out of sight.

Young children are also easily distracted, which can be utilized to manage pain during short procedures. Their attitude toward pain is passive—"it's something you have" and they tend to rely on others to help them cope. The presence of parents is very beneficial to the child experiencing pain. Children at this age are aware of only passive, concrete strategies to manage pain such as medication, food, and bandaids.

Concrete Operational Stage (7-10 years)
Children in the concrete operational stage of development understand that pain has aspects beyond the physical; that pain can make you sad, angry, or worried. They also take a more active stance toward managing pain and may include rubbing the sore area, exercising, talking with friends, playing video games, or watching television in their repertoire of pain management strategies. Pain is now understood to occur within the body and they can more readily localize internal pains. Pediatric pain questionnaires may be useful in this group. Children in this stage may still link pain with transgression and towards the end of this stage may see pain as dangerous and threatening. Children may exaggerate minor injuries. Interference of pain and disease with their normal childhood activities seems particularly aversive to this group, and active play and visits from friends should be encouraged.

Formal Operational Stage (12 years-adolescence)
Children at this stage of cognitive development are capable of introspection and abstraction. They understand that pain can interfere with their relationships with others and is a subjective, isolating experience—no one can feel what your pain is like. There is a realization that psychic pain may be more difficult to control than physical pain. Anxiety over the potential for future disability or disfigurement may accentuate pain and interfere with social acceptability and independence. Adolescents may have a very difficult time coping with pain during this time of rapid growth and development.

Cultural Considerations in Pain Perception

Acquisition of culture begins in infancy and continues throughout the life span. Children learn what behaviors are appropriate for different situations

from their family and community. There is a lot of theoretical argument concerning the influence of culture on children's pain, but the research in this area mostly focuses on adults. Experienced clinicians will tell you that there is a definite difference in the overt expression of pain in adults and children from different cultures, but it is not known currently whether the internal experience of pain is also different.

Gender Differences in Pain Perception

There are a number of gender differences in pain perception. Boys rate braces tightening as more painful than girls, while girls rate having a broken arm as more painful than boys. In general, girls grade many procedures as more painful than boys do and are more likely to feel fearful and anxious, while boys tend to feel angry.

Girls more often experience recurrent pain syndromes when they are otherwise healthy. Recurrent episodes of headache, abdominal pain, and limb pain, occur as often as 3-4 times per week. In cases such as these, there is no underlying pathology; the pain itself is the problem. Persistent pain problems in childhood may lead to debilitating pain in adulthood. If childhood pain problems were better recognized and managed, some disability in adulthood might be prevented. (NIH, 1998)

Acute Pain

Most of us understand acute pain very well because we have experienced it and observed it in others. With acute pain, the sympathetic nervous system is activated in response to real or potential tissue damage. This is the branch of the autonomic nervous system that controls the "fight or flight" response. The effects seen with sympathetic nervous system stimulation include:

- Increased heart rate and force of contraction
- Increased perspiration
- Dilation of bronchioles
- Constriction of blood vessels in skin, viscera, and external genitalia
- Increased blood pressure
- Increased respirations
- Decreased peristalsis
- Secretion of epinephrine and norepinephrine
- Relaxation of bladder and contraction of sphincters
- Contraction of pilomotor muscles of skin (goose bumps)
- Thick, viscous saliva
- Increased conversion of glycogen to glucose
- Dilation of heart and skeletal muscle blood vessels
- Dilation of pupils

With acute pain, especially procedure-related pain, decreased oxygen saturation, increased heart rate, respiratory rate, blood pressure, and sweating are common.

Psychological/Behavioral Responses

When we think of acute pain behavior, crying, moaning, grimacing, and even screaming comes to mind. Conversely, many in our society value a stoic response to pain. A common misconception is that increased experience with pain will teach a person to better cope with it. There are some problems with these beliefs about pain behavior. First of all, behavioral and physiological indicators may well be present with pain, but they are oftentimes brief. The body seeks equilibrium and will eventually return to baseline despite continued severe pain. Patients will often cease to have behavioral indicators as they attempt to keep a "stiff upper lip" or because they are exhausted from dealing with pain. Lastly, a number of research studies indicate that increased experience with pain actually leads to a more vigorous response to pain. (McGrath, & Pasero, 1999, p. 43)

Chronic Pain

Chronic pain is a significant problem in the pediatric population, affecting 15-20% of children. (Goodman & McGrath, 1991) Chronic pain can be persistent (ongoing) or recurrent (episodic), in a single or in multiple regions of the body. Ongoing pain can result in a sensitization of the peripheral and central nervous systems to produce neuro-anatomical, chemical, and physiological changes. (Williams, 2000) In chronic pain, neurons may get "rewired," causing pain impulses to continue beyond the painful event and unrelieved pain can become generalized to other areas. (Crabtree, 2000) At the very least, the physiological responses that are seen with acute pain have long since stabilized, leaving the child without overt physiological evidence of pain.

Psychological/Behavioral Changes

While all children that experience pain also experience anxiety, fear, and sadness incidental to their pain, children with chronic pain live with these emotional responses on a daily basis. Depression and apathy can result. Over time, the child's affect may

flatten and no overt pain behavior (crying, moaning, etc.) will be evident.

Children in chronic pain may not sleep well and they tire easily. The child's normal pattern of development (to become increasingly independent) is disrupted when they are passive and dependent on others to provide pain relief. Children often get secondary gains when they are in pain in the form of increased attention, being excused from activities they dislike, and staying home from school. These may contribute to the development of "learned" pain triggers. Parental anxiety also contributes to the development of learned pain triggers.

Parents who may already be overwhelmed by their child's diagnosis or the high-tech environment of the ICU or acute care unit may feel even more helpless when they see their child in pain. Parents may experience frustration, anger and a lack of control if they perceive their child as having inadequate pain management. Nurses and other caregivers may also feel stress as they care for the child with unresolved pain management issues. (Turner, 2005)

Children experiencing chronic pain may also be on medications that cause adverse effects such as nausea, limb aches, hair loss, mucositis, bloating, etc. Children with cancer often fear abandonment and death.

Assessing Responses that Indicate Pain

According the Joint Commission, we have an obligation to conduct a pain assessment in every patient. For most patients, we ask them about their pain and they tell us. With children, the assessment process can be a lot more complex. Infants and young children are pre-verbal and can't tell you about their pain. Children are often very anxious with health care providers and discerning pain from anxiety can be difficult. Pain assessment tools need to be tailored to the child's developmental level. There are a number of pain assessment tools that have been developed. Many of the pain assessment tools are based on a 10-point scale so that a pain rating of "4" is consistent across age groups and care areas. Use the pain assessment tools that your care area has chosen for the age groups you serve. If you would like to see some of the tools available, indicate this on your post-test.

Standard PC 8.10:
Pain is assessed in all patients. The identification and treatment of pain is an important component of the plan of care. Individuals are assessed based upon their clinical presentation, services sought, and in accordance with the care, treatment, and services provided. (JCAHO, 2006)

This means that <u>all</u> patients are entitled to an initial and on-going assessment of pain and once discovered, pain relief measures will be quickly instituted.

Considerations with Pain Assessment Tools

There are drawbacks to nearly all pain assessment tools. First, most assessment tools are geared to acute pain. Chronic pain is different in nature and the assessment tool may not be appropriate to use because:

- The sympathetic nervous system is no longer active and so the physical symptoms (↑HR, BP, etc.) are not present.
- Psychosocial influences are much more profound than with acute pain. Prolonged suffering leads to apathy, blunted behaviors and affect. Because the child is not moaning, crying, or having any other overt pain behavior it might be erroneously assumed that they are not in pain.
- Children who have lived with pain for a long time may not even recognize that they are in pain because they can't remember what it was like not to hurt.

Physiologic measures can also be problematic with acute pain because they can be misinterpreted. If a child in severe pain post-operatively is given an opioid infusion with a resultant drop in HR, RR, and BP, there is often a fear that the drop is opioid-induced rather than as a result of pain relief. Reversal agents may be inappropriately given in an instance such as this. A pulse oximeter can be used to determine whether the drop in RR has had any effect on the oxygen saturation. The HR, RR, and BP should be compared to the baseline vital signs and the patient monitored for sedation level.

Some tools also use the concept of "consolability" to distinguish between pain and anxiety. The premise being that if an infant can be consoled, it is probably anxiety or hunger and not pain that is making them cry. Research indicates that this may not be the case. When infants in one group were given pacifiers during circumcision, they cried 40% less than infants not given a pacifier. (Gunnar, Fisch, and Malone,

1984) One might conclude that a pacifier helped relieve pain. However, cortisol levels were increased in both groups (an indicator of physiologic stress). Therefore, the appearance of calming or soothing could be misleading. Use of a pacifier may provide distraction for the infant and is an appropriate non-pharmacologic pain management strategy, as long as it is *in addition to* pharmacologic strategies.

Another problem with pain assessment tools is that they deal with only one type of pain, while patients often have 3 or 4 different types of pain. In Caitlyn's case, not only does her broken arm hurt, but she also has a headache and a tummy-ache. Research indicates that 1/3 of patients report 4 or more different types of pains and that not all pains are opioid responsive. (Carling, 1997) It cannot be assumed that if an opioid is on-board that all the aches and pains will be cured. In Caitlyn's case, it would probably be wise to try an NSAID (non-steroidal, anti-inflammatory drug) to help with her bone pain and muscle spasms that accompany a broken bone, along with an opioid for the soft tissue pain. Non-pharmacologic interventions such as a cold pack for the headache or a warm water bottle for the tummy-ache, distraction, etc. will also help Caitlyn to feel better.

Table 1: Pain Types and Responsiveness to Opioids

Responsive	***Semi-Responsive***	***Resistant***
Visceral pain Soft tissue pain	Bone pain Nerve compression Pleuritic pain	Colic Muscle spasm Nerve destruction Neuropathic pain

Adapted from: Carling, M. (February 1997). Pain control: The need for an accurate assessment tool, Analgesia, 8(1), 3-7.

Misperceptions About Pain Assessment

Research on pediatric medication administration practices indicates that nurses do not administer the prescribed analgesic in a manner that adequately controls pain (Eland, 1977; Gadish, Gonzales, and Hayes, 1988; Beyer, DeGood, Ashley, and Russell, 1983) Nurses may withhold pain medication because of exaggerated fears about addiction or respiratory depression. The incidence of addiction in an adult receiving narcotics for pain is only about 1%; addiction in a child in the same circumstances has not been documented. Furthermore, there is no evidence that use of opioid analgesics early in life increases the risk of addiction later in life. (McCaffery and Pasero, 1999, p. 631) Although respiratory depression is more of a concern in infants because of increased penetrability of the blood-brain barrier, it can be easily monitored for and corrected if it should occur.

Nurses also have a tendency to modify a child's stated pain rating based on their behavior (i.e., they will chose a lower pain rating if the child is smiling, talking, playing, etc.). In fact, self-report, if available, is always preferred and is considered the best indicator of pain. (McCaffery and Pasero, 1999, p. 5) Children may use talking, joking around, and/or play as methods to control their pain.

What if the Child Denies Pain?

Sometimes a child will choose to deny pain when in fact they have it. A denial of pain should be suspect when there is tissue damage and pain is expected or if there are behavioral or physiological responses that suggest pain.

Children sometimes deny pain because they fear that they will get an injection if they admit that they have pain. For this reason, analgesics should be given IM or subcutaneously only if absolutely necessary. Sometimes children deny pain because they fear drug addiction. The difference between street drugs and medications used to treat a condition should be explained to the child and/or parent. There may be other reasons why a child may deny pain, such as being able to go home sooner or to avoid further painful treatments. If the child feels guilty about the cause of their pain, such as from an injury, the child may choose to suffer in silence because they believe that the pain is punishment they deserve.

If there is a suspicion that pain exists, explore with the child and parent the possible reasons why a child might deny pain. If there is still suspicion after talking with the child and/or parent, a trial dose of an analgesic is probably indicated. The nurse should record the behaviors or physiological indicators that suggest pain before administering the medication and then assess after the analgesic has had time to work. Talk with the parent and child to see if they notice any difference after the analgesic was given.

Procedural Pain

The pain we inflict upon children in the course of their treatment bears special consideration. Children have told us that of all the things that caused them pain in the hospital (including surgery), procedures were the most painful (IV starts, blood draws, etc.). (Eland, 1981) The other problem is that procedures often have to be done over and over again. It is vital to give serious consideration to reducing procedural pain, especially with the first experience. Making the first experience as pain-free as possible will go a long way to reducing anxiety and the need for sedation

with subsequent procedures. If there is any question whether a given procedure is painful, it must be assumed that pain is present. If no analgesics are administered and it becomes apparent that a procedure thought not to be associated with pain is causing pain, analgesics must be added. Many of the barriers to effective management of procedural pain revolve around the misconceptions that people have about procedural pain. Let's look at a few:

Misperception: Giving local anesthetics and analgesics for procedures is complex. They require special administration techniques and have unmanageable side effects and risks, especially for premature infants, neonates, infants, children, and the elderly

When administered correctly, local anesthetics and analgesics used for procedural pain are safe and effective in almost all populations of patients with minimal side effects that are easy to detect and manage. The techniques used to administer the local anesthetics and analgesics for many procedures are simple to master with proper training.

Misperception: Giving the analgesic/anesthetic hurts as much as the procedure.

A number of easy-to-apply techniques can be used to reduce the discomfort associated with drugs that are painful when administered (e.g., buffering and warming lidocaine and adding lidocaine to propofol).

Misperception: There is not enough time available to provide anesthesia and analgesia before procedures, and most procedures are brief and over before the anesthetic or analgesic takes effect.

Poor planning is not justification for failing to provide adequate procedural pain control. Most anesthetics and analgesics recommended for procedural pain have a rapid onset of action and can be titrated or re-dosed if necessary during the procedure to maintain adequate pain control. Institutional protocols and standardized pain management plans can be developed for the routine management of most procedural pain, making preplanning easier.

Misperception: If the procedure is brief, the pain will be brief and tolerable.

Procedural pain serves no useful purpose and has many damaging consequences. Research shows that a number of adverse physiologic, psychologic, and emotional effects of unrelieved pain exist, even if the pain is brief and temporary.

Misperception: If given enough sedation, patients will not feel or remember the pain.

Benzodiazepines do not have any analgesic properties except for muscle spasm. Sedation does not reduce pain and it does not eliminate the memory of it.

Misperception: Caregivers know that the procedure is painful and will do all they can to relieve pain during the procedure.

For years patients have tolerated without analgesia or anesthesia procedures such as venipuncture, immunization, circumcision, and tubing and line placement, believing that their caregivers are doing all they can to relieve their pain. Subjecting patients to this practice is no longer justified in light of the many drugs and methods available to control pain. Patients have a right to aggressive pain management, including the control of procedural pain.

(Source: McCaffery and Pasero, 1999, p. 364.)

The main goal of procedural pain management is for the patient to experience adequate pain relief during the procedure. Other goals include minimizing anxiety, having the child cooperate during the procedure, and a speedy and safe recovery from the effects of the procedure. Not all procedures are painful. Some produce anxiety but no pain, such as MRI and CT scans. Children often find these procedures frightening and they have difficulty remaining motionless. In cases such as these, sedation can help to decrease anxiety, but analgesia is not needed. However in most cases, procedures cause both pain and anxiety in children and both analgesia and sedation are often needed. If a procedure is expected to be painful, an analgesic must be given (AHRQ, 1992). Keep in mind that benzodiazepines such as midazolam (Versed) and diazepam (Valium), as well as the chloral hydrate (a sedative/hypnotic), only produce sedation and have no analgesic properties. Table 3 lists several common procedures and identifies which ones may require sedation and/or analgesia.

> ***"The key to managing procedure-related pain and distress is anticipation"*** (Source: American Academy of Pediatrics and American Pain Society, 2001, page 794).

Managing procedural pain in children cannot be a "one-size-fits all" approach. Anxiety and resulting pain perceived during a procedure are affected by more than just what will be done, it will also be affected by:

- How much the child/family thinks it will hurt,
- How long they think the pain will last,

- The context and meaning of the procedure,
- What the child has endured in the past, and
- The family support system.

A professional approach to managing procedural pain would use a variety of techniques and medications in anticipation of what will be experienced by the child given the factors listed above.

Table 2: Procedures That May Require Analgesia and/or Sedation

Procedure	Analgesia/ Anesthesia	Sedation
Bone marrow aspiration or biopsy	X	X
Burn debridement	X	X
Cardioversion	X	X
Chest tube placement	X	X
Chest tube removal	X	X*
Circumcision	X	
Dressing changes	X	X*
Endoscopy	X	X
Incision and drainage of abscess	X	X*
Immunization	X	
Lumbar puncture	X	X*
Minor dental, podiatric, plastic, urologic, and ophthalmic surgical procedures	X	X*
Paracentesis	X	X
Placement or removal of implanted devices	X	X
Placement of catheters, lines, and tubings	X	X*
Radiologic procedures (CT, MRI)		X*
Reduction and immobilization of fractures	X	X
Suturing of lacerations	X	X*
Thoracentesis	X	X
Tissue biopsies	X	X *
Venipuncture	X	
Weaning from mechanical ventilation	X†	X*

Source: McCaffery, M., Pasero, C. (1999). *Pain: Clinical manual*, Mosby, p. 365.

Table 2, continued

*The decision to add sedation may vary from what is suggested in the table depending on the patient's age, condition, and anxiety level. Opioid analgesics alone may provide adequate sedation in some instances. If the patient has high anxiety or previous experience with uncontrolled pain, additional sedation may be needed.

†Discontinuation of analgesics before weaning from mechanical ventilation is not recommended.

Information from Carrol KC, Magruder CC: The role of analgesics and sedatives in the management of pain and agitation during weaning from mechanical ventilation, *Crit Car Nurs Q* 15(4):68-77, 1993.

Pharmacologic Interventions for Procedural Pain

Local anesthetics and opioids are the mainstay pharmacological agents for managing pain during procedures. Sedation may be added to reduce anxiety. General anesthetics, such as ketamine, propofol, and nitrous oxide, may also be used to manage procedural pain. NSAIDS, opioids, and local anesthetics can be used for preemptive analgesia (treatment of pain before it actually occurs). Let's review some of the basics about these pharmacologic agents.

Local Anesthetics

Local anesthetics are used to control the pain of procedures, both minor and major. They work by blocking nerve conduction and can completely anesthetize an area. Local anesthetics can be injected subcutaneously to numb an area for minor procedures such as venipuncture and suturing, or used to block selected nerves or to produce a regional block that covers a large area. Local anesthetics can also be administered topically.

Because local anesthetics are absorbed rapidly, they can produce systemic toxic reactions. Monitor for circumoral numbness, metallic taste, dizziness, blurred vision, tinnitus, and decreased hearing. The presence of any of these symptoms warrants discontinuing the local anesthetic and could require emergency management.

EMLA Cream

Eutectic mixture of local anesthetics (EMLA) combines lidocaine and prilocaine in a cream for topical application to intact skin. EMLA can be used to reduce the pain of many procedures: venous, arterial, lumbar, finger, and heel punctures; implanted port access; peripheral insertion of central catheters (PICC lines); for removal of sutures and staples;

injections; placing epicardial wires or cardiac catheterization lines, etc. EMLA needs to be applied directly to the site involved 1-2 hours before the procedure, and an occlusive dressing placed over the top. The cream should be applied thickly. Do not rub it in. The occlusive dressing can be a piece of Tegaderm or any plastic wrap (e.g. Saran Wrap) with tape used to seal the edges. It is a good idea to cover the dressing so the child won't disturb it and to label the dressing as "EMLA applied" with the date and time. Apply EMLA to more than one site for venous access, in case the first try is unsuccessful.

Although EMLA has been shown to be safe and effective for use in infants less than 12 months of age, there have been two instances reported of methemoglobinemia. These cases have led many practitioners to avoid using EMLA for painful procedures in infants less than 12 months. The manufacturers warn against its use in infants less than one month and in infants less than 12 months who are receiving treatment with methemoglobin-inducing agents, such as acetaminophen and sulfonamides.

LMX4 Cream
LMX4 cream is a local topical anesthetic cream similar to EMLA but without the Prilocaine. This product is applied to intact skin that has not been prepped with alcohol or other skin oil removing agents. Slightly rub the product into the skin at the procedure site, apply a larger dollop of the cream and cover with a transparent permeable membrane dressing for 30 minutes. Check with your institution for age parameters.

TLC, TAC, and LET
There are several solutions and gels that can be used for topical anesthesia. TLC is a combination of tetracaine, lidocaine, and cocaine. TAC combines tetracaine with epinephrine (adrenaline) and cocaine, while LET combines lidocaine with the epinephrine and tetracaine. These combination mixtures are often used before wound cleaning and repair of uncomplicated face and scalp lacerations. The gel or solution is painted into and around the wound with cotton applicators or squirted directly into and around the wound and left in place for 10 –30 minutes. Avoid contact with the mucous membranes because they more readily absorb the medication than the wound bed. The anesthesia is superficial and does not extend to the submucosal structures. Do not use on tissues with end arteriole blood supply such as fingers, toes, penis, nose, or ears because of the vasoconstrictive effects.

Refrigerant Sprays
For superficial procedures, refrigerant spray should be considered when time is insufficient for EMLA to take effect. When the refrigerant is sprayed on the skin, it rapidly cools the surface, allowing a 10-15 second period of analgesia for "pinpoint" surface procedures such as needle insertion. Two disadvantages are that incorrect application can lead to frostbite and that children may object to the extreme cold.

Iontophoresis
Iontophoresis (Numby Stuff) is a method of transdermal drug administration in which drug particles are transported through the skin by mild, low-level electric currents. Steroids, opioids, and local anesthetics have all been administered successfully this way.

The typical Numby Stuff treatment lasts about 10 minutes and produces dermal anesthesia to a depth of 10 mm, lasting up to 100 minutes. It can be used for IV catheter insertions, injections, implantable port needle insertion, shave biopsies, pulsed dye laser therapy, and blood drawing.

Opioid Analgesics

Opioids act by binding to receptor sites in the brain and spinal cord to block the production of neurotransmitters. This blocks the transmission of pain impulses. Morphine, fentanyl, hydromorphone (Dilaudid), and meperidine (Demerol) are the most common opioids used for procedural pain because they provide the most reliable pain control. These agents have no analgesic ceiling (an amount beyond which further doses provide no additional pain relief) and can be adjusted to meet a patient's individual requirements.

Morphine is the "gold standard" against which other pain relief from opioids is measured. Demerol (meperidine) has no advantage in use over other opioids, but instead has a distinct disadvantage when used as a more than a one-time dose. Meperidine's metabolite (normeperidine) may accumulate leading to central nervous system irritability and seizures which are not amenable to anticonvulsant drugs or reversal by naloxone. Therefore, it is no longer recommended that meperidine by used for critically ill children or adults (Oakes, L., 2001, p. 566).

Fentanyl is preferred most often for short procedures because of its rapid onset (1-2 minutes), peak effect (3-5 minutes), and short duration of action (3.6 hours). It should be diluted and administered slowly to prevent chest wall rigidity (2-5 minutes). (McCaffery and Pasero, 1999, p. 378) Morphine lasts longer than fentanyl in the body and may be more suitable for longer procedures and when pain is expected to continue after the procedure.

There are a number of factors that need to be taken into consideration when deciding the route of medication delivery. If the child has an IV access, intravenous administration of opioids provides a more rapid and reliable onset of analgesia than seen with other routes. The intravenous route allows for more precise titration of the medication and immediate access should reversal agents be required. If an IV access is not in place and the child is unlikely to need one post-procedure, an oral route of medication delivery may be chosen. The oral route is often used for anesthetic premedication in the operating room and before conscious sedation for therapeutic or diagnostic procedures. Oral transmucosal fentanyl citrate (OTFC or fentanyl lollipop) is ideal for providing conscious sedation and as a premedication for surgery and procedures. If the patient is NPO, a rectal route of administration may be chosen. IM injections should be used only as a last resort, particularly for ongoing medication. Children find shots very frightening and painful and will often lie about their pain if they believe that admitting pain will result in receiving an injection.

Nonopioid Analgesics: Acetaminophen and the NSAIDs

Acetaminophen is a nonopioid, but it is not a NSAID (non-steroidal anti-inflammatory agent). NSAIDs have varying degrees of anti-inflammatory, antipyretic, and analgesic properties. Acetaminophen has similar analgesic potency to NSAIDs but lacks the peripheral anti-inflammatory effects. Acetaminophen rarely causes the gastrointestinal problems that are associated with the NSAIDs, but it may cause liver toxicity and should be used with caution in patients with liver disease.

Aspirin is rarely used in pediatric patients because of its association with Reye's syndrome. NSAIDs that are commonly used in children include ibuprofen, naproxen, indomethacin, and choline magnesium trisalicylate. For children who are NPO, intravenous ketorolac is available.

Remember those chemical mediators? NSAIDs help to minimize the effects of chemical mediators (inflammation and sensitization of nociceptors). NSAIDs are not particularly effective for treatment of the immediate pain associated with procedures because they do not directly block pain receptors and they take a while to work. They are effective, however, for preemptive analgesia and to manage pain after the procedure is over. Pain (acute or chronic) that is caused in part by inflammation (such as postoperative pain and arthritis) may actually respond better to a NSAID than to an opioid. NSAIDs are most effective against mild to moderate inflammatory pain of somatic origin and are less effective against visceral pain. They are particularly effective against bone pain. NSAIDs also play an important role in reducing the amount of opioids needed to manage pain. Because opioids act centrally and NSAIDs act peripherally, they work very well in combination, attacking pain through two different neural mechanisms.

Benzodiazepines

For relatively painless procedures, benzodiazepines may be used alone to provide sedation, muscle relaxation, antegrade amnesia, and to reduce anxiety. However, if a procedure is expected to produce pain, an analgesic must be added because benzodiazepines do not relieve pain. (Schechter, Berde, and Yaster, p. 448) Keep in mind that personnel who administer, monitor, and recover patients from procedural sedation must meet certain competency requirements.

Midazolam (Versed) is recommended as the drug of choice for conscious sedation. (McCaffery and Pasero, 1999, p. 381) It has a rapid onset of action (1-5 minutes) and a short half-life (1-12 hours). Midazolam may be given IV, IM, IT, orally, rectally, and intranasally. Because the intranasal route can cause intense burning, irritation, and lacrimation, the IV and oral routes are preferred in children.

Diazepam (Valium) is another drug commonly used for procedural sedation. The oral route of administration is recommended for diazepam because it is very painful when injected IV and has variable absorption when given rectally or IM.

Barbiturates

Barbiturates are used less frequently than benzodiazepines to produce sedation during procedures. Barbiturates may lower the pain threshold, especially when pain is already present. (Schechter, Berde, and Yaster, 1993, p. 381)

General Anesthetics

General anesthetics, given at subanesthetic doses, to manage the pain and anxiety of procedures is becoming increasingly common. Only personnel experienced in the effects of general anesthetics and comfortable maintaining an airway should administer these agents.

Ketamine, propofol, and nitrous oxide are all agents that may be used to manage procedural pain. Ketamine produces sedation, amnesia, and marked analgesia. It can be administered IV, IM, orally, rectally, and intranasally.

Propofol, when administered in subanesthetic doses does not significantly reduce pain but is capable of producing excellent sedation. It must be given IV and is often administered by continuous drip to provide sedation for children receiving regional anesthesia, intensive care, or palliative care.

Nitrous oxide is a short acting inhalational anesthetic that provides rapid and potent analgesia with minimal depression of the respiratory, cardiovascular, and central nervous systems. It is given as a mixture in oxygen.

Chloral hydrate

Although chloral hydrate has long been the mainstay of pediatricians, it is not without significant risk. This drug, even when used in usual doses, has the potential of causing major injury or death because of its long half-life and metabolites. There have been many instances cited in the literature of infants and toddlers who have appeared to be recovered from the sedative effects of the drug but, because of residual drug and active metabolites still circulating in the child, suffers re-sedation once they are no longer stimulated. Thus these patients must be closely monitored for airway obstruction and de-saturation. Chloral hydrate also tastes bad, is irritating to the skin and mucous membranes, and has a significant rate of failed sedation at low doses. (Cote, Karl, Notterman, Weinberg, and McClosky, 2000).

DPT (Demerol, Phenergan, and Thorazine)

This combination of drugs should never be given. The DPT or "pedi-cocktail" has been prescribed for years to sedate pediatric patients for painful procedures. Use of the DPT persists despite the 1995 American Academy of Pediatrics warning against its use and the fact that it is no longer listed in the *Harriet Lane Handbook* as a drug suggested for procedural pain management.

Non-Drug Approaches to Procedural Pain

Although pharmacological management of procedural pain is the most common approach, non-drug pain relief methods may be a beneficial supplement. Keep in mind that non-pharmacologic methods are really coping strategies and not pain reducing strategies. Although there are exceptions to this, such as in the use of cold, most techniques make the pain more tolerable, not necessarily less severe in intensity.

Techniques such as guided imagery, relaxation, and meditation require time up-front of the procedure to learn and practice. For this reason they are not often used to manage procedural pain. If a procedure will need to be performed over and over, caregivers need to take the time to help the patient perfect methods that will be used with each procedure. See the section on acute and chronic pain management to learn more about these techniques.

To reduce anxiety and discomfort and promote relaxation, a number of techniques can be used. The premise for using many of these methods hinges on the idea that feelings and even the sensations associated with pain can be modified by changing thoughts and behaviors.

Techniques to Manage Procedural Pain and Anxiety

- If the child will need repeated procedures, maximize treatment for pain and anxiety of the first procedure to minimize the development of anticipatory anxiety before subsequent procedures.
- Provide developmentally appropriate preparation of the child for the procedure. Adjust the timing of the preparation to meet individual needs and preferences.
- Reduce environmental stimuli as much as possible (lower light and noise level).
- Handle all tubes, drains, and catheters gently.
- Remove all tape and dressings slowly.
- If the child is old enough, ask them if they would like to change their own dressings and apply topical medications.
- Use moisture-retentive dressings that will not adhere to the wound bed; use adhesive dissolvents if not contraindicated.
- Ask the child how to best turn and position them; do this slowly and gently.
- Establish a central line instead of repeated venous and arterial punctures when appropriate. In premature infants and neonates, use umbilical catheter (if in place) instead of repeated venous and arterial punctures.
- Group blood draws to minimize the number of venipunctures per day.
- Have only expert staff attempt IV access on the most unstable patients or those with poor veins.
- For premature infants, minimize the amount of tape and be careful in its removal.
- Allow the parents or guardian to stay with the child during procedures. Before you begin the procedure, let the parents know what the procedure will involve and how they can best help their child.
- Conduct procedures out of the patient's bed and room whenever possible. Their bed should be a safe place.

- Swaddle infants; use cutaneous stimulation techniques (e.g., for term neonates, rub the opposite extremity during heel puncture); provide neonates and premature infants with objects for sucking and grasping.
- Once the procedure is complete, pick up the infant and hold them (or have the parents do this).
- Use cold to reduce the pain of procedures where there is localized pain or inflammation (for example, injections). Apply cold to the site before the procedure and again after for continued pain relief.
- Counterirritation is a way of using nonpainful stimulation, such as massage, pressure, or scratching to block pain sensation. The simple act of scratching before and during local anesthetic infiltration can reduce the perception of pain.
- 24% sucrose is an effective adjunct to the reduction of procedural pain in neonates and infants. It is administered by dipping a pacifier into the sucrose solution and then offering the pacifier to the infant, or by dropping the sucrose directly onto the tongue of the infant. There are several commercially prepared products that contain 24% sucrose in a single use container that will allow dipping of a pacifier. The use of a pacifier along with the sucrose is synergistic because it encourages non-nutritive sucking and hand-to-mouth calming behavior. Sucrose has been found to be effective for procedural pain control (blood drawing, starting and IV, heel stick) by elevating the pain threshold via the endogenous opioid system. It decreases physiologic (heart rate, metabolic rate) and behavioral (time spent crying) pain indicators. The optimal effect of sucrose is achieved when administered two minutes prior to the procedure. The duration of effect is approximately 5 minutes. (Stevens, Yamada, Ohlsson, 2006).
- Distraction can make procedural pain more bearable by putting pain at the periphery of awareness. The child's attention is focused on the distractor rather than the procedure. Some distractions that can be used include books, videos, video games, music, toys, blowing bubbles, talking to the patient, a pacifier, etc.
- Use a noninvasive tissue adhesive rather than sutures to close lacerations.

Adapted from McCaffery, M., and Pasero, C. (1999). Pain Clinical Manual, p. 390, Mosby, Inc. the AHCPR quick reference guide, Acute Pain Management in Infants, Children, and Adolescents: Operative and Medical Procedures., and Stevens, Yamada, and Ohlsson, 2006.

Acute and Chronic Pain Management

Many of the same drugs that are used to manage procedural pain are also used to manage acute pain. There are also a number of non-pharmacological techniques that can be used in conjunction with drugs to make the child more comfortable and less anxious.

Pharmacologic Interventions

There are three main groups of medications that are used to relieve pain in both acute and chronic pain situations: Nonopioids, opioids, and adjuvants. Each group affects pain mechanisms differently and has its own set of clinical considerations.

Nonopiods

Nonopioids include both acetaminophen and NSAIDs. Nonopioids may be used with both nociceptive (somatic and visceral) pain and neuropathic pain. They are more effective with nociceptive pain, especially with muscle and joint pain. Ketorolac (Toradol) is a parenteral medication that is often used in acute pain situations such as trauma or surgery, where the patient is unable to take a nonopioid orally.

Nonopioids are often combined with opioids for their additive analgesic effects and to reduce the amount of opioids needed. If one NSAID is ineffective, try another. For acetaminophen, pain relief may be evaluated within 2 hours. For NSAIDs, initial pain relief may be evaluated within 3 hours. Depending on the half-life of the drug, pain relief can be evaluated within 2 to 7 days with repeated dosing.

Opioids

Opioids control pain by locking onto the opioid receptors located in the CNS, pituitary gland, and GI tract and blocking the release of neurotransmitters, particularly substance P. Opioid analgesics also block substance P peripherally by binding to the opioid receptors in the peripheral nerve cells.

Opioids are divided into agonists and agonist-antagonists. Mu agonists, such as morphine, codeine, fentanyl, hydrocodone, and hydromorphone are capable of managing all pain intensities and are effective for many different conditions. Agonist-antagonists, on the other hand, are not recommended as the first-line drugs for any type of pain. (AHRQ, 1992) Agonist-antagonists have a ceiling to analgesia, limited routes of administration, and can precipitate reversal of opioid effects and withdrawal when given to patients receiving opioid agonists.

Some clinicians use agonist-antagonist opioids believing that they cause less respiratory depression than the mu agonists, but at equianalgesic doses all opioids produce equal respiratory depression. (McCaffery and Pasero, 1999, pg. 188)

Opioids are usually used for pain that is moderate to severe that cannot be managed with a nonopiod. The route used will depend on the patient situation. Intravenous administration may be given via PCA (patient-controlled analgesia), by continuous infusion, or bolus dosing. Opioids may also be administered epidurally, subcutaneously, orally, rectally, transdermally, oral transmucosally, or intranasally. PCA's are generally used in children 7 years and older.

For children with developmental or cognitive delays an option of family-controlled analgesia may be considered. The nurse must carefully evaluate candidates for parent-controlled analgesia before training them to activate the device on behalf of the child. Nurses should not use the patient controlled action of the PCA device, but instead should use a clinical bolus or other overrides as needed for procedures such as turning and wound care. (Oakes, L., 2001, p. 567). According to a JCAHO sentinel event alert published in 2004, PCA errors usually occur due to family and/or health care professionals administering doses to the patient by proxy in an attempt to keep them comfortable. Patients should be encouraged to use their PCA themselves when they hurt.

Adjuvants

Adjuvants can be defined as drugs that have a primary indication other than pain but are analgesic for some painful conditions. The term adjuvant can also refer to analgesics that are added to enhance pain relief and/or minimize side-effects. Adjuvants used in this way might also be referred to as coanalgesics. Adjuvants can be used as an "add-on" therapy to an opioid regimen or as a distinct primary therapy. For almost all patients with persistent moderate to severe acute pain caused by advanced incurable disease, opioids should be initiated and titrated to maximum effect before an adjuvant analgesic is added. Let's explore some of the misperceptions about adjuvant analgesics.

Misperception: Adjuvant analgesics are as reliable in producing pain relief as are opioids or nonopioids.

Fewer patients respond adequately to adjuvant analgesics than to opioids and nonopioids. Furthermore, adjuvants tend to have a much slower onset of analgesia and more side effects.

Misperception: Adjuvants are only effective for chronic neuropathic pain.

Some adjuvant analgesic such as tricyclic antidepressants, corticosteroids, and psychostimulants are multipurpose analgesics that may be useful for both acute and chronic pain.

Misperception: Adjuvant analgesics are appropriate only for chronic, not acute, pain.

Some adjuvant analgesics such as clonidine are useful for both acute and chronic pain.

Misperception: Use of adjuvant analgesics is usually no more time consuming than use of other analgesic groups.

Drug selection and dose titration of adjuvants is more difficult and "labor intensive" than with opioids and nonopioids.

Misperception: Pain relief from antidepressants depends on their ability to relieve depression in the patient with pain.

The analgesic effect of antidepressants is not dependent on their antidepressant activity. Both depressed and nondepressed patients with pain report analgesia. Furthermore, the analgesic dose is often lower than that required to treat depression, and the onset of analgesia typically occurs much sooner, usually within one week.

Misperception: Antidepressants are more appropriate analgesics for burning neuropathic pain than for stabbing and knifelike neuropathic pain.

Research shows that antidepressants may be effective for both lancinating (knifelike) and continuous neuropathic pain.

Misperception: Drugs marketed as muscle relaxants, such as methocarbamol (Robaxin), relieve muscle pain by relaxing the muscle.

No evidence exists that "muscle relaxants" relax skeletal muscle in humans. Although these drugs can relieve musculoskeletal pain, this may not be due to relaxation of skeletal muscle.

(Source: McCaffery and Pasero, 1999, p. 303)

As a group, adjuvant analgesics tend to be less reliable analgesics, can take weeks to obtain optimal results, fewer patients respond adequately to adjuvants than opioids, and many of the adjuvant drugs are more likely to produce troublesome side

effects than the opioids. Despite all of that, adjuvant analgesics are valuable during all phases of pain management to enhance analgesic efficacy, treat concurrent symptoms, and provide independent analgesia for specific types of pain. Adjuvants include*:

Corticosteroids help to elevate mood, reduce inflammation, stimulate the appetite and reduce vomiting. They also reduce cerebral and spinal cord edema.

Anticonvulsants are used for neuropathic pain, particularly with lancinating or burning pain.

Antidepressants are used to manage neuropathic pain. These drugs have innate analgesic properties and may potentiate the analgesia provided by opioids.

Neuroleptics have been used to treat chronic pain syndromes. Methotrimeprazine will not affect the gut the way that opioids will and can be useful for opioid-induced intractable constipation or other dose-limiting side effects. Methotrimeprazine can also help to reduce anxiety and emesis.

Local anesthetics have been used to treat neuropathic pain, but the side effects for these drugs may be greater than for other drugs used to treat neuropathic pain.

Hydroxyzine is an antihistamine with anti-emetic properties. In addition, it is a mild anxiolytic with sedating and analgesic properties.

Psychostimulants can be used to reduce opioid-induced sedation when reducing the dose and increasing the frequency does not correct the problem.

*Some of these medications are not approved for use in the pediatric population (especially in children less than 12 years) because of the lack of research.

Coanalgesia

There are several reasons for considering the use of more than one analgesic to manage pain. First of all, combining drugs will attack more of the underlying mechanisms producing the pain. Second, combining drugs allows for smaller doses of each of the individual analgesics, which will reduce side effects. Lastly, patients often have more than one type of pain and different analgesics may control each type of pain more effectively. There are some general guidelines for combining analgesics:

Acetaminophen
It is common practice to give acetaminophen along with any of the NSAIDs, opioids, or adjuvants. Including acetaminophen will usually add analgesia without increasing side effects.

NSAIDs
It is not recommended that more than one NSAID be used at a time because there is little additional analgesia and the risk of side effects is considerable. A NSAID used with a corticosteroid should be approached with caution because of increased side effects such as gastric ulceration.

Opioids
It is highly recommended that nonopioids, such as acetaminophen and/or a NSAID, be combined with an opioid for pain management. In most instances, only one opioid should be used at a time. Opioids can be combined with adjuvant analgesics for chronic pain and for acute pain as well if the adjuvants have a reasonably rapid onset of action.

Adjuvants
Adjuvants from one group of drugs may be combined with analgesics from any other group (exception: use caution when combining a NSAID with a corticosteroid). For example, a corticosteroid, psychostimulant, tricyclic antidepressant, and an anticonvulsant might all be used along with an opioid and acetaminophen for chronic pain.

Treatment of Chronic Pain

Because of the multi-factorial nature of chronic pain, a multi-modal treatment approach is often more effective than a single sequential treatment approach. (Williams, 2000) It is important to identify all sources of pain and evaluate contributing factors. A multi-modal approach includes specific treatment targeting possible underlying pain mechanisms and managing symptoms such as sleep disturbance, anxiety, or depressive feelings. Treatment also needs to address pain-related disability, with the goal of maximizing function and quality of life. (Williams, 2000)

Here are a few guidelines to use in managing chronic pain in children:

- Thoroughly assess the pain.
- Believe the patient's report of pain (child's and/or parent's).
- Respect individual differences. Not everyone will experience or deal with pain in the same way.
- Reassess frequently during early stages of treatment.
- Use the right drug for the right type of pain.
- Use the least invasive method.
- Give long-acting drugs to keep serum levels closer to therapeutic windows, and give them around the clock for predictable analgesia.

- Change the drug dose as needed but not the dosing interval.
- Use dosing equivalents to better prescribe effective pain management and individualize therapy. Make sure the patient is receiving an equi-analgesic dose when switching from IV to PO (hint: You will need to give more).
- Anticipate and treat side effects.
- When necessary, use drugs in combination for their synergistic effects.
- Help patients (and parents) understand that some tolerable level of pain may remain.
- Assess functional ability and quality of life.
- Consider and treat other illnesses that occur along the way.

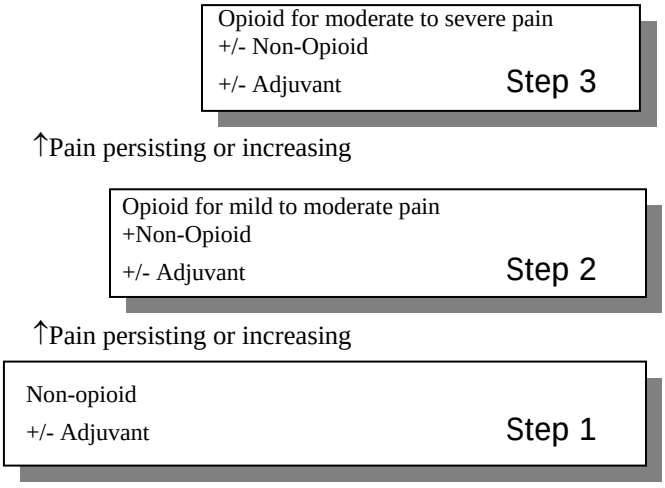
Guidelines adapted from those presented by Dr. Matthew Lefkowitz, Director of Pain Management Service at New York Methodist Hospital, at the 2000 National Primary Care Nurse Practitioner Symposium.

Procedures should be performed consistently so that that children and parents know what to expect. Parents are a key element; spend time discussing all the factors influencing their child's pain and garner their support. Encourage the parents to have their child live as actively and fully as possible, with a normal routine and normal discipline. Make sure the parents understand that they are setting themselves up for failure when they approach new treatments believing that they won't work. Because of the complex nature of chronic pain syndromes, you may want to consult a pain specialist.

The WHO Ladder

The WHO ladder is a three-step analgesic ladder developed by the World Health Organization for the treatment of cancer pain.

Figure 4: The WHO Ladder



Using the WHO ladder, a non-opioid such as acetaminophen or non-steroidal anti-inflammatory drug should be used for mild to moderate pain unless contraindicated (Step 1). When pain persists or increases, add an opioid (Step 2). If pain continues or becomes moderate to severe, increase the opioid potency or dose (Step 3).

Other considerations with the WHO Ladder are:

- Use the simplest dosage schedules and least invasive pain management modalities first.
- Substitute drugs within a category before switching therapy. If pain relief is not attained with the maximum dosage of one NSAID, try another NSAID before abandoning NSAID therapy.
- Schedule doses "by the clock" to maintain the level of drug that will help prevent recurrence of pain. Ask for patient and family cooperation in establishing the effective level.
- Administer medications for long-term cancer pain on an around-the-clock basis, with additional doses "as needed."
- Tailor the treatment regimen to fit the individual needs of the patient.

Non-Drug Approaches to Acute and Chronic Pain Management

Physical Approaches

Heat and cold have long been the “home remedy” of choice. Both can be effective in reducing discomfort. Heat serves to increase the blood supply to an area and can be helpful with decubiti, superficial boils, superficial thrombophlebitis, anorectal pain, and for hematoma resolution after the acute phase of bleeding has stopped. Cold reduces the blood supply to an area and is preferable to heat for pain relief in the presence of acute trauma, bleeding, swelling, in an acute state of rheumatoid arthritis, and tissues with an irreversible inadequate blood supply (heat may increase metabolic demand and necrosis). Headache, especially migraine, may be very responsive to the application of cold. Both heat and cold may relieve muscle aches or spasms, joint pain, and itching. When cold relieves pain, it usually does a better job of it than heat. (McCaffery and Pasero, 1999, p. 408) If you cannot apply the cold or warm pack directly over the area that hurts, try placing it on the opposite side of the body, above or below the area that hurts. Always follow safety precautions to prevent burns or freezing of skin. If the application of heat or cold increases pain, discontinue its use. Try alternating heat and cold (e.g., every few seconds or minutes) or intermittent heat to produce a heating and cooling effect. This technique has been shown to be

extremely effective even for severe pain (Gammon, Staff, 1941).

It can be difficult to get a child, especially a young child, to accept application of a cold pack. Explain, in developmentally appropriate language, the benefits of applying cold. Gradually introduce cold by wrapping the cold pack in several layers of cloth and removing the layers one at a time. You can also try placing a warm, moist cloth between the skin and the cold pack. Make sure that the child is protected from generalized chilling by being warm at the start and adding additional warmth as needed.

Massage can be soothing and relaxing, both physically and mentally. Massage for relaxation is usually done with smooth, long slow strokes over the whole body, or just the back, feet, or hands. Use a warm lubricant such as hand lotion and massage area for 3-10 minutes. Reported benefits of massage include relaxation, improved sleep, decrease of pain, lowered blood pressure. (McCaffery and Pasero, 1999, p. 420)

Positioning is routinely used to promote comfort and decrease decubitus ulcer formation. Pillows, special mattresses, blankets, and rolled up cloth diapers have all been used to facilitate patient positioning. Supine positioning of infants is currently recommended by the American Academy of Pediatrics because it has been shown to decrease the incidence of SIDS (sudden infant death syndrome).

Babies who are swaddled tend to be calmer and gain weight more rapidly. (Cole, Jorgensen, 1997) In preterm infants, swaddling after heelstick immediately quieted crying, decreased heart rate, and facilitated return to a sleep state. (Fearon, Kisilevsky, Hains, et al., 1997) When the same infants were not swaddled, it took at least 10 minutes for them to return to baseline physiological and behavioral states.

Immobilize when necessary to manage acute pain or to stabilize fractures or compromised limbs and joints. Use adjustable elastic or thermoplastic braces to help maintain correct body alignment.

TENS, or transcutaneous electrical nerve stimulation, is a controlled, low-voltage electrical stimulation applied to large myelinated peripheral nerve fibers via electrodes placed on the skin to inhibit pain transmission. TENS is used to relieve pain caused by a variety of chronic and acute pain conditions such as:

- Neck and lower back pain
- Headache/migraine
- Shingles
- Bursitis
- Childbirth
- Arthritis
- Post-herpetic neuralgia
- Sciatica
- Temporomandibular joint pain
- Osteoarthritis
- Amputation
- Fibromyalgia
- Post-surgical pain
- Fractures
- Muscle and joint pain
- Sports injuries
- Menstrual cramps

(Source: Turkington, 1999)

Vibration is a form of electrical massage. Vibration can have a soothing effect when applied lightly, or a numbing effect when applied with moderate pressure. (Ekblom, Hansson, 1985; Lundeberg, Ottoson, Hakansson et al., 1983) Vibration can also change the character of the pain from sharp to dull. (Bini, Cruccu, Schady et al., 1984) Appropriate situations for use of vibration include:

- Muscle pain or spasm
- Tension headache
- Itch
- Near an injection site (i.e., during IM injection)
- Neuropathic pain (e.g., postherpetic neuralgia; surrounding the area if the site itself is too sensitive)
- Phantom limb/stump pain
- Chronic orofacial pain
- Tooth extraction
- Acute tendinitis
- As a substitute for TENS
- Various types of chronic nonmalignant neuropathic or musculoskeletal pain

Do not use vibration in patients that bruise easily, in areas of thrombophlebitis, in migraine headache or headaches that worsens with movement or sound, or over areas that have been burned or cut.

Cognitive Approaches

Relaxation, guided imagery, and distraction are all examples of cognitive strategies. In general, cognitive strategies should be used only as an adjunct to other pain management strategies. Cognitive strategies do not reduce pain. Instead, they function by reducing the distress associated with pain by placing the pain on the periphery of awareness. In order for cognitive strategies to be effective, some basic principles need to be followed:

- The child must be willing to participate.
- The child must be old enough to understand and cooperate with the technique.
- The child must have enough energy to participate.
- The child must trust the coach (parents can make good coaches).

- Ideally, the coach should not perform the procedure.
- Allow sufficient time to learn the technique and have the parent practice the technique at home with their child.
- It might not work on the first try--practice helps. Several techniques may need to be employed, depending on the child and the situation.

Relaxation will not only reduce the distress associated with pain, but can also help manage other pains that can result from anxiety, such as muscle tension. Controlled breathing is often used to encourage relaxation. The child is taught to take slow, deep breaths in through the nose and out through the mouth. The process should be modeled and the child encouraged to practice the technique. Sometimes it is helpful to have the child imagine the breath going to the place of discomfort, grabbing a piece of hurt and exhaling it out. Sometimes another image, such as the ocean rolling in and out, can be helpful. The child should develop their own image to use for future stressful encounters. Sometimes it is helpful to use a relaxation tape, especially if they have trouble getting to sleep.

“Blowing the pain away” is a form of controlled breathing that is effective with young children. The child is taught to blow out as hard as they can at the first sensation of pain. This can be particularly effective for IM injections and blood draws. For a toddler or older child, blowing bubbles can be both distracting and relaxing by encouraging slow, rhythmic breathing. The child can be taught to take a deep breath and slowly blow away anything bothersome with the bubbles.

Relaxation for an infant or young child may consist of simply holding the child, or rocking them in a rocking chair. Preterm infants generally respond better to swaddling, reducing stimulation, allowing sucking (pacifier), and providing something to grasp. (Schechter, Berde, and Yaster, 1993, p. 313)

Guided imagery is a widely used cognitive strategy which taps into the imagination. Generally children aged three and older are able to participate in imagery experiences.

Children might be asked to imagine a "pain switch," like a light switch, that can be turned off where pain is inflicted (such as in the thigh for an IM injection). A similar strategy is the "magic glove," where children are asked to imagine a magical glove that can be placed, finger by finger, on the hand. Once the glove is in place, it will lessen any discomfort of a needlestick.

Some children prefer to build a personal image of a safe place that they enjoy. The more senses that the child uses to build this image, the more real it will seem. The child can then "go to the beach" when they are in a stressful situation. If you have access to a play therapist or child-life specialist in your area, they can be excellent resources for developing cognitive strategies or any other aspect of managing pain in children.

Distraction has long been used to divert a child's attention from the painful procedure to another stimulus. The child might passively watch something distracting, such as a kaleidoscope, pop-up book, or the television or they might become actively involved in another activity such as Nintendo playing, blowing bubbles, counting ceiling tiles, or sucking on a pacifier. Engaging the child in conversation about something they love (birthday, pets, holidays, vacations, toys, etc.) can also provide distraction for brief procedures.

Music can also be used as an effective distraction technique. Even children paralyzed with pancuronium bromide were found to reduce their heart rate, blood pressure, and intracranial pressure when music was piped through headphones. (Kachoyeanos and Friedhoff, 1993)

Pain in Infants

Why focus on pain in infants? Because they are the most unlike adults of all the subgroups within pediatrics in terms of physiology, cognitive function, and behavioral responses.

Infants, especially preterm neonates, are extremely vulnerable to pain and its negative consequences and pain in this group is less well controlled than at any other age. Let’s review some of the misperceptions that exist regarding pain in this group:

Misperception: Infants are incapable of feeling pain.

Infants have the anatomic and functional requirements for pain processing by mid to late gestation.

Misperception: Infants are less sensitive to pain than older children and adults.

Term neonates have the same sensitivity to pain as older infants and children. Preterm neonates may have a greater sensitivity to pain than term neonates or older children.

Misperception: Infants are incapable of expressing pain.

Although infants cannot verbalize pain, they respond with behavioral cues and physiologic indicators that can be observed by others.

Misperception: Infants must learn about pain from previous painful experiences.

Pain requires no prior experience; it need not be learned from earlier painful experience. Pain is present with the first insult.

Misperception: Pain cannot be accurately assessed in infants.

Behavioral cues (i.e., facial expressions, cry, body movements) and physiologic indicators of pain can be reliable and validly assessed either alone (univariate approach) or in combination (multivariate approach). The most valid univariate approach is facial expression. The most valid multivariate approach is through the use of a composite pain measure.

Misperception: Infants are incapable of remembering pain.

Early exposure to noxious stimuli may have an effect on the infant's future responses to painful events.

Misperception: Analgesics and anesthetics cannot be safely given to infants and neonates because of their immature capacity to metabolize and eliminate drugs and their sensitivity to opioid-induced respiratory depression.

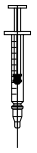
Infants older than 1 month of age metabolize drugs in the same manner as older infants and children. Careful selection of the agent, dosage, administration route and time, and frequent monitoring for desired and undesired effects, and drug titration and weaning can minimize the adverse effects of opioids and nonopioids for pain management in neonates.

(Source: McCaffery and Pasero, 1999, p. 627.)

Pharmacology and the Neonate

Neonates metabolize drugs differently than the older child and adult. Let's look at some of these differences.

The gastrointestinal system of the neonate provides an unstable acid environment and slower gastric emptying. This leads to higher concentrations of acid labile drugs, as well as delayed and incomplete absorption of some medications.



Distribution of drugs within the body tends to be larger, producing lower peak levels in the infant than the adult given the same dose of medication. The IM (intramuscular) absorption of some medications may be delayed in infants. Because of delayed absorption, opioid levels in the serum may increase many hours after a one-time IM or subcutaneous dose in infants who are opioid-naïve. Monitoring should be continued, therefore, for 12 hours after an opioid dose. (University of Washington)

Passage of opioids such as morphine into the brain is increased in neonates and can lead to decreased ventilatory responses to hypoxia and hypercarbia, especially in the preterm neonate. Animal studies suggest that this group has higher analgesic requirements along with an increased risk of respiratory depression. (Williams, 2000; Schechter, Berde, and Yaster, 1993, p. 524) For this reason, neonates should be closely monitored with a cardiorespiratory monitor and pulse oximetry when on opioids. The opioid dose should be titrated for effect. Neonates can develop tolerance to opioids quickly and large doses may be needed to keep pain under control. (Schechter, Berde, and Yaster, 1993, p. 524; McCaffery and Pasero, 1999, p. 629)

Drug clearance depends on liver and kidney function. Neonates, particularly preterm neonates, have slower hepatic and renal metabolism due to immaturity. Most analgesic medications will have a significantly longer half-life in the neonate. The preterm infant will require lower doses or longer dose intervals than the term neonate due to differences in renal functioning.

Intravenous administration of opioids is the most common pain intervention in the NICU. IV pain medications are administered to provide analgesia during mechanical ventilation, invasive monitoring, and surgical procedures. In addition, sedation may be combined with analgesia for procedures and postoperative pain management.

Painful Conditions

Neonates in intensive care units typically undergo many invasive procedures and, on average, only 3% of such procedures are currently undertaken with appropriate analgesics. (International Concensus Group for Neonatal Pain) Intubation and mechanical

ventilation can also be quite painful. Chest tubes and even IVs can be painful, depending on what's running. Measures must be taken to reduce the pain and distress associated with having the "standard" set of tubes in the NICU as well as during painful procedures. This is often done by providing both opioids for pain relief and sedation to calm and promote rest. (Schechter, Berde, and Yaster, 1993, p. 529) When sedatives and opioids are combined, it often reduces the amount of either drug required. Because use of these drugs can cause respiratory depression, they are usually judiciously tapered before weaning is done. Opioid analgesics, sedatives, and anti-anxiety agents should never be abruptly discontinued if they have been administered for more than a few days because withdrawal symptoms may occur.

Environment, Safety, and Comfort Measures

Preterm infants need a fair amount of environmental management because of their immaturity; they are simply not yet ready for life outside the womb. They do best with a warm, dark, quiet environment where interruptions are kept to a minimum. For this reason, it is often best to move the preterm infant to an isolette (incubator), rather than an overhead warming bed, whenever their condition will allow it. The isolette provides humidity and consistent warmth free of drafts. The warm, humid environment will help their respiratory systems and skin. The isolette will also help to deaden some of the noise that is generated in the NICU and a blanket can be placed on top of the isolette to “shade” the infant from the harsh overhead lighting. Turn off any excess lights. All articles coming in contact with the child’s skin should be warmed, including stethoscopes and hands. If you are able to dedicate a stethoscope to each infant, it works well to leave the end of the stethoscope in the warming bed with the child so that it is always warm and ready to use.

Preterm infants do best when they have large blocks of time for uninterrupted rest. Group cares so that they can be accomplished with a minimum of disruption to the infant. If possible, work around the infant’s own sleep/awake cycle. Try to schedule tests and procedures so that the child is allowed adequate rest to recover from the stress of the procedure before another one is performed. This is especially important if the infant has just been extubated or is unstable. If the infant needs a rest, place a “Do Not Disturb” sign on the isolette so that examinations and procedures will not be conducted without your knowledge. Group blood draws to minimize the number of times a child is stuck for tests. Suction only on an "as needed" basis.

The skin of preterm infants is extremely fragile. The more premature the infant, the more fragile the skin. Always use the absolute minimum of tape necessary to accomplish the task and remove it with extreme care. Even with care, the skin of very premature infants will often sustain abrasions during tape removal. If you use a transcutaneous monitoring device, move the probe often to prevent the probe from burning the skin. Do not use creams, oils, or powder on the skin unless needed. Be cautious in applying products to a preterm infant’s skin that are not approved for your area. Chemicals in these products can be absorbed through the skin.

Positioning an infant correctly will increase the safety and comfort of the child. The American Academy of Pediatrics currently recommends that healthy term infants be placed for sleep on their backs because it is associated with a lower rate of Sudden Infant Death Syndrome (SIDS) than other positions. Other positions may be appropriate depending on the child.

When placing an infant on their back, be careful not to hyperextend the neck. Infants have a relatively soft airway, predisposing them to obstruction if the neck is hyperextended. Be sure to protect IVs, tubes, and lines from accidentally being pulled out. With older children, tubes and lines need to be protected from being bitten in half, as well as from exploring fingers. Bandaids should not be placed on the fingers of infants because they can pose a choking hazard.

Infants find swaddling to be very comforting, presumably because it simulates the tight conditions of being in utero. If swaddling is not possible due to IVs and other equipment, try containing the infant by stretching a thermal blanket across the infant and tucking it in. Use blanket or cloth diaper rolls to help with positioning, such as placing one at the back to prevent the infant from rolling out of a side-lying position or to elevate an extremity.

Pacifiers and sucrose-dipped pacifiers have both been found to be effective comfort measures for infants. (Schechter, Berde, and Yaster, 1993, p. 523)

Sarah is a 28 week preterm neonate with respiratory distress syndrome who is in an overhead warming bed, is intubated and on a ventilator. Over the last 12 hours her respiratory status as been unstable and she has had numerous x-rays, blood draws, examinations by physicians, and her ET tube has been retaped twice. Her heels bear marks from several capillary blood draws. There are several tape abrasions on her

skin. When you approach the bed you see that she is silently crying, arching, and thrashing. What can you do to help Sarah?

Possible answers might include the following:

- Swaddle Sarah if it does not interfere with temperature regulation or observation.
- Locate a pacifier that will fit in Sarah's mouth with the tube in place. Nonnutritive sucking can be very calming to an infant.
- Check to see if Sarah has orders for analgesia. If not, obtain an order.
- If Sarah does not calm after the pain medication has peaked, check to see if sedation can be ordered (particularly if she is "fighting" the ventilator). It is unlikely that Sarah will be extubated soon so sedation should not present a problem.
- Switch Sarah to an incubator (isolette) as soon as it is safe to do so. Shade Sarah from the overhead lights. Decrease noise and excess lighting.
- Have an arterial line placed if frequent blood draws are expected.
- Only allow expert staff to start IVs and conduct blood draws (if a needlestick is required).
- Cluster cares to allow 2-3 hours of uninterrupted rest. Place a "Do Not Disturb" sign on Sarah's bed.
- Warm all articles that come in contact with Sarah's skin.
- Minimize any tape that is used and be very careful in its removal.

Teaching Parents About Pain

Parents (or other primary care givers) play a key role in the longterm success of health interventions; they take over the care of their child after discharge. Parents need to not only understand what is happening to their child but how they can help. Teach parents how to assess for pain and how to intervene appropriately. Studies indicate that parents often have certain beliefs that might cause them to withhold pain medication. One study indicated that about half of parents believed that their children could become addicted when opioids were used for pain relief and about one-third thought that children who take pain medicine regularly might learn to use drugs to solve other problems later on in life. (Finley, et.al., 1996)
Reinforce that pain medicine (if ordered) is an important part of their child's care. Address any concerns the parents may have about using pain medicine.

Parents can also be a valuable asset at the child's bedside to provide non-pharmacologic interventions and to provide consistency from shift to shift, caregiver to caregiver. If it is important for the child to have undisturbed rest, explain the need for this to the parents. Schedule some "holding time" where the parent can hold and/or rock their child. All but the sickest neonates will benefit from being held.

Include the parents in care decisions and have them begin to do daily cares as soon as possible. If parents want to be present when procedures are performed, educate them as to how they can best help their child.

Conclusion

The health care professional caring for the child in pain has a tough job indeed. There are many physical, emotional, and cognitive differences to keep in mind, along with communication issues. There are also an abundance of misperceptions that abound, making it difficult to get the proper pain interventions ordered and delivered to the patient. However, there is also a lot of research that will support you as you advocate for your young patients.

Joint Commission standards say that we need to assess and treat pain in every patient. Now would be a great time to use a team approach to developing pain protocols for your area if they do not already exist. It is also a great time to revise and update your pain protocols if it's needed. Education alone is not the answer—it rarely changes practice. (Dahl, 2001) New organizational processes must be developed so that changes in clinical practice are supported.

Directions for Submitting Your Post Test for Contact Hours

To obtain a certificate of completion for this home study program, please complete the post-test and evaluation on the next few pages. The date on your certificate of completion will be the date that your home study is received. **Any materials received with a postmark after the expiration will be discarded.**

HealthEast, HCMC, & MVAMC Employees
If you are an employee of HealthEast, HCMC, or MVAMC, you may send the post-test and evaluation to TCHP for processing. Your post-test will be returned to you through your hospital. It cannot be mailed to your home.

Paid Participants
If you are not an employee of one of the TCHP hospitals, please send the post-test and evaluation to TCHP with a check for $24.00. Please make check payable to **TCHP Education Consortium** and mail to:

TCHP Education Consortium
Capitol Office Building
525 Park Street, Suite 120
St. Paul, MN 55103

Your post-test will be returned to you with the certificate of completion.

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Pediatric Pain Management
Post- Test

Please print all information clearly and sign the verification statement:

Name_____
(please print legal name above)

Birth date (required) Format: 01/03/1999								
	M	**M**	**D**	**D**	**Y**	**Y**	**Y**	**Y**

For HealthEast, HCMC, or MVAMC, employees only:
Hospital _____ Unit_____

Personal verification of successful completion of this educational activity (required):
I verify that I have read this home study and have completed the post-test and evaluation.

_____
Signature

1) Pain impulses are NOT carried on:

   a) C-fibers
   b) Unmyelinated fibers
   c) A-delta fibers
   d) Elastic fibers

2) At what stage do children to take a more active stance toward managing their own pain?

   a) Preoperational
   b) Concrete Operational
   c) Formal Operational

3) How does chronic pain differ from acute pain?

   a) Physiological changes may be absent
   b) Overt pain expression may be absent
   c) None of the above
   d) Both a and b

4) What is the best indicator of pain in a child?

   a) Physiological changes
   b) Behavioral changes
   c) Self-report of pain
   d) None of the above

5) Which procedures are likely to require BOTH analgesia/anesthesia and sedation?

   a) Setting a broken leg
   b) Circumcision
   c) Getting a shot
   d) Starting an IV

6) Why would you want to give an analgesic during chest tube placement when the patient is already sedated with Versed®?

   a) You want to make sure they don't wake up
   b) To attack pain using 2 different neural mechanisms
   c) To increase alveolar ventilation
   d) Because Versed® does not relieve pain

7) Non-drug approaches to pain management usually:

   a) Are used instead of pain medication
   b) Do not relieve pain
   c) Are a good supplement to pain medication
   d) Both b and c

8) Which of the following comfort measures are appropriate to use with a preterm neonate?

   a) Warm articles that come in contact with their skin
   b) Swaddling
   c) Group cares to minimize handling
   d) Turn off unnecessary lights
   e) All of the above

☐ Check here if you would like a copy of some of the pain assessment tools that are available.

Expiration date: The last day that post tests will be accepted for this edition is **December 31, 2017**—your envelope must be postmarked on or before that day.

Evaluation: Pediatric Pain Management

Please complete the evaluation form below by placing an "X" in the box that best fits your evaluation of this educational activity. Completion of this form is required to successfully complete the activity and be awarded contact hours.

At the end of this home study program, I am able to:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Identify the physiological basis of pain.					
2. Correlate possible manifestations of pain to developmental age.					
3. Describe three essential components of pain assessment.					
4. Describe one or more medications that are used for pain management in children.					
5. Identify at least three non-pharmacological interventions for pain.					
6. Identify three or more common misconceptions about managing pain in children.					
7. The teaching / learning resources were effective. *If not, please comment:*					

The following were disclosed in writing prior to, or at the start of, this educational activity (please refer to the first 2 pages of the booklet).	Yes	No
8. Notice of requirements for successful completion, including purpose and objectives		
9. Conflict of interest		
10. Disclosure of relevant financial relationships and mechanism to identify and resolve conflicts of interest		
11. Sponsorship or commercial support		
12. Non-endorsement of products		
13. Off-label use		
14. Expiration Date for Awarding Contact Hours		
15. Did you, as a participant, notice any bias in this educational activity that was not previously disclosed? *If yes, please describe the nature of the bias:*		

16. How long did it take you to read this home study and complete the post test and evaluation:
_____hours and _____minutes.

17. Did you feel that the number of contact hours offered for this educational activity was appropriate for the amount of time you spent on it?
____Yes
____No, more contact hours should have been offered
____No, fewer contact hours should have been offered.

Expiration date: December 31, 2017